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# The Efficacy of Guided and Unguided Game-Based Cognitive-Behavioral Therapy in Reducing Distress in College Students

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## Abstract

**Objective:** College students' mental health is an international prioritized research subject. Dedicated interventions are constantly developed to be more suited, attractive, and effective and to reach as many students as possible. Our study aims to investigate the efficacy of an online game-based cognitive-behavioral therapy transdiagnostic intervention (REThink game) in reducing psychology students' distress.

**Method:** Our sample consisted of 139 students (mean age 26.27; 17 male students and 122 female students) who voluntarily enrolled in our study, and they were randomly assigned to 1 of our 3 groups (REThink game without guidance  $n=44$ ; REThink game with guidance  $n=46$ ; or care-as-usual control group  $n=49$ ). They completed the pretest questionnaires (distress [negative functional and dysfunctional emotions], rational, and irrational cognitions), then they were offered to play the trial version of the REThink game, and after that, two specific levels focused on relaxation with mindfulness abilities, and on cognitive change emotion-regulation abilities. After completing the game, students in the REThink game with guidance received email support aimed to help them implement the skills learned in the game.

**Results:** Results showed medium effect size improvements for the REThink game without guidance group compared to the control group in terms of dysfunctional negative emotions and improvements in irrational cognitions for both experimental groups compared to the control group.

**Conclusion:** So far, the REThink therapeutic game proved to be a promising innovative, efficient, and highly accessible intervention for helping students manage distress.

Trial Registration: ClinicalTrials.gov NCT04763954.

**Keywords:** Cognitive-behavioral therapy, Game-based CBT, Distress, Online CBT

## Efficacy of Game-Based Cognitive-Behavioral Therapy

COLLEGE STUDENT'S MENTAL health is a subject of great interest and major importance for research and interventions in recent years.<sup>1</sup> The most important and global action is represented by the de World Mental Health International College Student (WMH-ICS) Initiative (<https://www.hcp.med.harvard.edu/wmh/index.php>). The purpose

of this initiative is to collect data regarding the mental health of the students from different countries and to develop and test evidence-based interventions.

Studies focused on this issue investigated the mental health problems of college students in different countries. Auerbach et al<sup>2</sup> performed a review where they analyzed surveys from eight countries and their results show that 28.4% of the responding students met the criteria for at least one mental health disorder in the last 12 months. The

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most common mental health issues were the emotional ones (depression, anxiety) and then the behavioral problems, especially for minorities which had the lowest rate for accessing the mental health services. One of the most well-documented common risk factors for emotional disorders is stress,<sup>3</sup> and it is widely present in students' lives. Karyotaki et al<sup>4</sup> reported that students are dealing with different types of stress related to all aspects of their life (e.g., academic, financial, social).

Considering the high prevalence of stress and emotional disorders in college students' population, therapeutic intervention programs were developed and tested to improve students' mental health, and cognitive-behavioral therapy (CBT) proved to be effective.<sup>5-8</sup> Out of the need to offer access to effective interventions, online therapy was suggested as a solution that can rapidly reach the affected students.<sup>9</sup> These interventions are easily accessible to students, proved to be widely accepted by them and have demonstrated positive results.<sup>10-12</sup>

Harrer et al<sup>10</sup> performed a systematic review for online interventions for mental health in students and obtained positive impact for depression, anxiety, stress, and eating problems. Positive results were also reported for an online intervention aimed to reduce the academic dropout<sup>11</sup> and social anxiety.<sup>13</sup>

Hintz et al<sup>14</sup> also performed a study to test the efficacy of an online intervention for stress reduction in students. Their intervention consisted of four explanatory modules, each covering a stress-related subject, with or without feedback. Their results showed that the intervention lowered the levels of stress, anxiety, and depression in students.

#### *Online self-delivered versus guided interventions for college students*

Online interventions are usually self-help type of interventions or guided online interventions. Guidance is defined as any type of help provided by a specialist (usually coach) by telephone, email, or even face-to-face, at the end of the intervention, between sessions or on demand. There are systematic reviews that demonstrate the role of guidance in online intervention for adults<sup>15</sup> and reviews that found no differences between guided and unguided interventions.<sup>16</sup> Considering these results, the role of guidance in online interventions is not very well established and this issue is even more questionable when it comes to students, due to the few studies that are published regarding the subject.

There are clinical trials that investigated guided online interventions in students and showed positive results in somatic symptoms and related distress,<sup>17</sup> reducing stress and preventing depression,<sup>18</sup> and anxiety,<sup>19</sup> but more research is needed to have a clear conclusion about the use of guidance in online intervention for students.

#### *Game-based therapeutic online interventions for college students*

Online interventions can include various types of protocols, ranging from online live-sessions, modules, exercises, or interactive gamified or game-based interventions. Gamified intervention uses the game mechanism in a nongame context to achieve the desired effect while game-based

interventions use games to promote learning and achieve outcomes. Indeed, online game-based interventions in mental health are an innovative initiative to help raise awareness, prevent mental illness, and improve mental health, which is becoming more and more popular. Systematic reviews that investigated the effect of game-based online interventions for mental health show that these new types of interventions are promising; however, there are still few well-designed studies that investigated their efficacy,<sup>20</sup> and most of them are targeted on specific diagnoses.<sup>21</sup>

Thus, even though game-based therapeutic interventions are accessible, attractive, acceptable, and feasible, their efficacy depends on the game design,<sup>22</sup> and thus, there is an imperative need for future studies to describe in-detail the game-based interventions and investigate their outcomes in rigorous trials. Even so, there are few recent studies that investigate the impact of game-based intervention for reducing mental health stigma in students. Mullor et al<sup>23</sup> investigated a game-based intervention to reduce stigma associated with mental problems in students and their results showed that the game is an effective intervention to reduce mental health stigma compared to direct contact with people suffering from mental health problems. The same result on reducing stigma regarding mental health problems was obtained by Cangas et al.<sup>24</sup>

The REThink therapeutic game (Fig. 1) is a unique action game that was developed based on a CBT curriculum namely on Rational Emotive Behavioral Therapy (REBT) as a standalone and transdiagnostic intervention aimed to prevent emotional disorders in youths.<sup>25</sup> This game was tested in a clinical trial<sup>25</sup> with children and adolescents aged 10–16 and the results showed that the REThink game is an efficient intervention for changing emotional symptoms, depressive mood, and improving emotion regulation skills. Moreover, changes in irrational cognitions were associated with changes in depressive mood and negative emotions.<sup>26</sup> Since age was not found to be a significant moderator for the outcomes, we wanted to test the online game on university students.

REBT is a form of CBT that has a very good empirical support, and it was developed by Beck<sup>27</sup> and Ellis.<sup>28</sup> It is efficiently used in therapy of several mental health problems for children and adults.<sup>29</sup> The central idea of CBT is that not the external events that make us feel in a certain way but our interpretation of the events which are our cognitions. In CBT, there is difference between rational cognitions (which are logical, empirically supported, healthy, and useful for individuals) and irrational cognitions (which are not empirically supported, unhealthy, illogical, and unhelpful for individuals).

Since the emotions are caused by our cognition, we have functional emotions (health and helpful in the specific situations) such as sadness, concern, and discontent that are caused by rational cognitions and dysfunctional emotions (unhealthy and unhelpful) such as depression, anxiety, and anger that are caused by irrational cognitions. The goal in CBT is to help individuals change their irrational cognitions with rational ones to improve their emotions.<sup>29</sup>

Since game-based interventions are becoming more and more popular and the college student population is a vulnerable category in terms of mental health, it is important to investigate the efficiency of the game to have more



FIG. 1. Levels of the game.

accessible, valid, and easy to use interventions for them. Also, related to the game-based interventions is the use of guidance, which has mixed results in literature, and it needs more investigation to establish whether it is an important ingredient in the success of the game-based intervention for students.

#### Aim of the study

The aim of the study is to investigate the efficiency of a game-based CBT, with and without guidance, in reducing distress of college students. Stress is one of the most common risk factors for emotional disorders,<sup>3</sup> and it is widely present in college students' lives.

#### Hypotheses

Hypothesis 1: College students receiving the game-based CBT (with and without guidance) will report lower levels of distress compared to the control group, after the intervention.

Hypothesis 2: College students receiving game-based CBT (with and without guidance) will report lower levels of irrational cognitions compared to the control group, after the intervention.

Hypothesis 3: College students receiving game-based CBT (with and without guidance) will report higher levels of rational cognitions compared to the control group, after the intervention.

Hypothesis 4: College students receiving game-based CBT with guidance will report higher improvements on the considered outcomes compared to the game-based CBT without guidance group.

#### Methods

The study is a randomized control trial with three arms. We performed measurements before the intervention, after

the intervention, and in the middle of the intervention in an ecological stressful examination situation.

#### Participants

Participants were psychology students in the last year who received a small bonus to an examination for their participation into the study. Participants were randomized in three groups using a randomization program. The first group was the game-based CBT with guidance group, the second group was the game-based CBT without guidance group, and the third group was the control group. The mean age of the participants was 26.27 years old; we had in sample 17 male students and 122 female students.

In our study, the inclusion criteria for participants to be enrolled were as follows: a college student who has access to a desktop device with internet and to be able to complete the questionnaires and access the game. The exclusion criterion for not to be enrolled as a participant was the inability to access a desktop device with internet. All participants involved in the study signed an informed consent, which described all the steps and procedure used in the study, and our study received ethical approval from the university's Ethics Board.

#### Measurements

We measured distress and rational and irrational cognitions. The questionnaires were completed online in a Google Form.

We used the profile of emotional distress (PED)<sup>30</sup> to measure distress. PED is a self-report measure for negative functional emotions and negative dysfunctional emotions, and it has good psychometric proprieties with Cronbach's alpha of 0.87 for our sample.

We used the Attitudes and Beliefs Scale 2 Abbreviated Version (ABS-2-AV)<sup>31</sup> to measure participants' cognitions, and for our sample, Cronbach's alpha was 0.70, which indicates good internal consistency.

### Intervention

Game-based CBT interventions groups (with or without coaching as guidance). The RETHink game has seven levels, each level focused on a specific ability. In level 1, players learn emotion recognition (they see a character and have to choose the emotion represented by the character); in level 2, players practice relaxation and mindfulness (they are taught a relaxation technique and have a mindfulness task); in level 3, players learn the difference between rational and irrational cognitions [they have to eliminate the irrational cognitions (represented by birds) from a tree]; and in level 4, users learn how to change their thoughts (they have to select the correct potion to neutralize the thoughts of the characters).

In level 5, players learn and practice a problem-solving model (they have to solve a maze); in level 6, users have a positive attention training (they have to select the happy faces on the screen); and in level 7, players practice all previously learned abilities and compassion (they have to walk in a parc and they have exercises to practice each ability). Each level is composed of three sublevels (e.g., level 1 has 1.1, 1.2, and 1.3), and the average play time of a level is between 10 and 20 minutes.

### Procedure

After enrolling to participate in the study, all students received a link to complete the pretest questionnaires. They had 3 days for completing all pretest. Then, participants in the game-based CBT groups were invited to access the trial of the game. They had a day and a half to complete the trial of the game (which is composed of the first sublevel from each level). Once they completed the trial section, they were given access to two levels of the game (level 2 and level 4). They had once again a day and a half to complete the two levels. After completing the game, participants in the

game-based CBT with guidance condition received email coaching.

All participants completed afterward the posttest questionnaires (they had 3 days to complete the scales). Also, students performed an additional measurement during intervention in an ecological stressful examination situation. They completed the questionnaires one more time in a day with the examination from their examination session for this specific situation. For a visual explanation of the protocol see Figure 2.

**Game-based CBT without guidance group.** In our study, participants in the game-based CBT without guidance received access to the trial of the RETHink game (first sublevel from each level) and then to the level 2 (relaxation and mindfulness) and level 4 (cognitive change). We chose level 2 to test the effect of the in-game relaxation and mindfulness exercises and level 4 because it trains the main mechanism of change in CBT. The participants played the RETHink therapeutic game using a web platform. They received a link to sign in with a personal account and then they received access to the game.

**Game-based CBT with guidance group.** Participants in the game-based CBT with guidance condition received the game in the same form as participants in game-based CBT without guidance and the day after they completed the game an email where they were congratulated for their success and were asked to submit in the same day two forms, the ABC model<sup>28</sup> and GROW model.<sup>32</sup> They were asked to think about a situation where they had an emotional difficulty and analyze that situation using the ABC model form. Then, based on that situation to set a goal related to the improvement of their emotional abilities and develop a plan for it using the GROW model form.

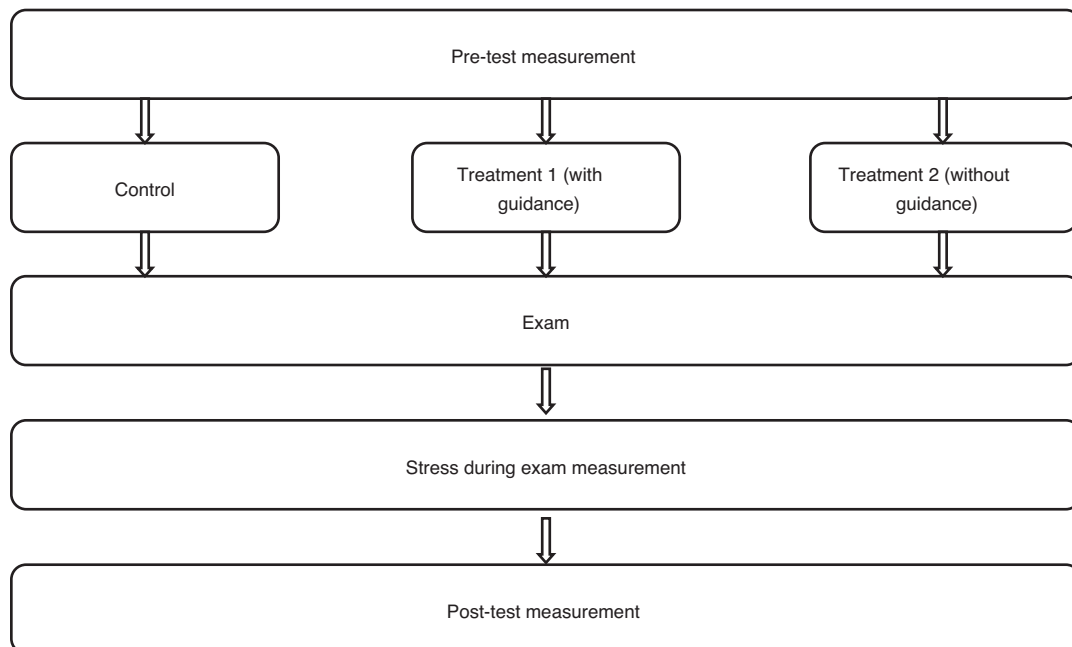


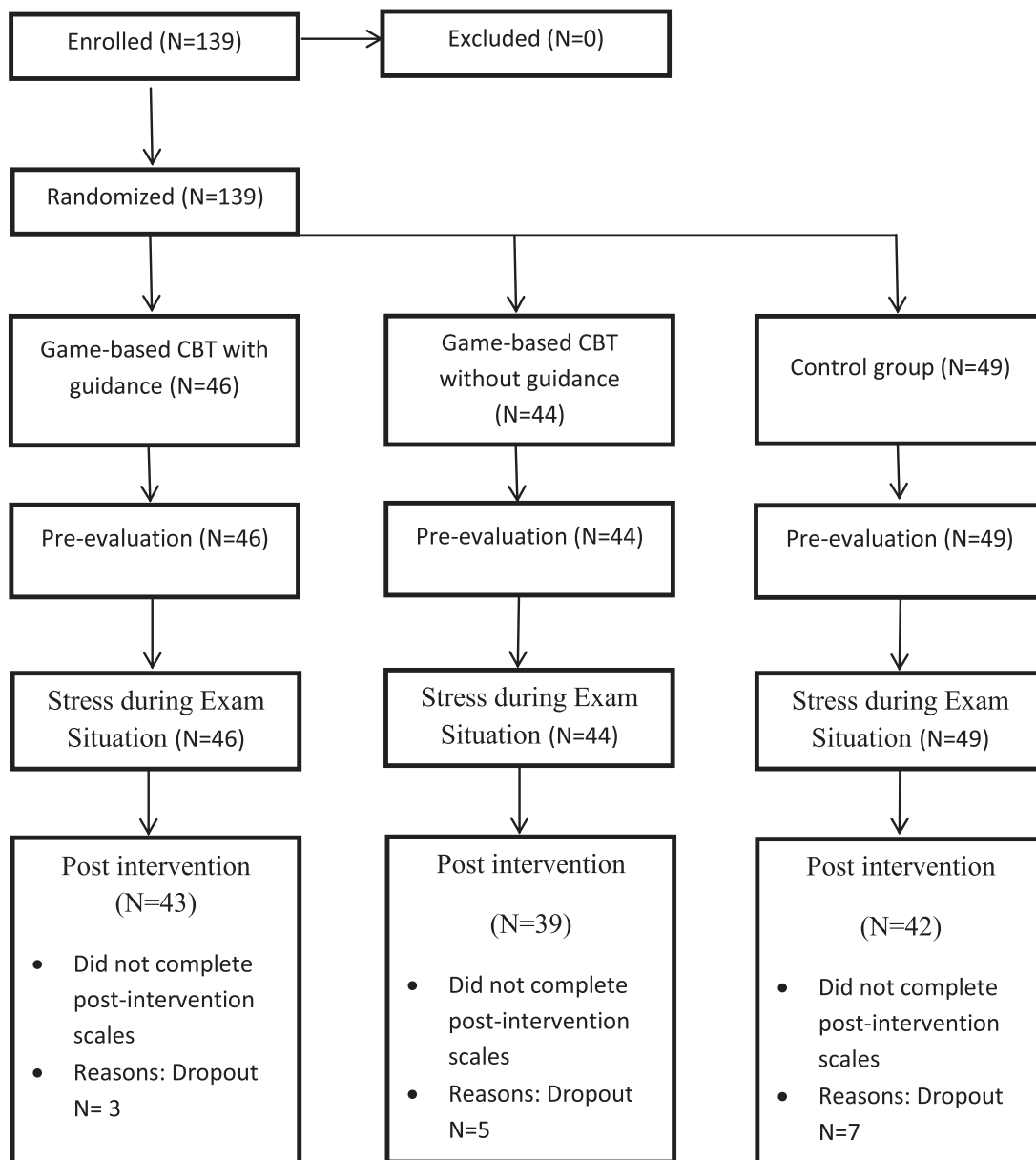
FIG. 2. Protocol of the study.

After they send the forms, the next day, they received email-based personalized feedback regarding the approach of their objectives based on the ABC and GROW forms, and also, they were encouraged to apply their plan and reminded on the importance of the implementation of their plan for their goals. We chose to use email coaching because it is widely used with success as guidance to an online intervention with demonstrated results.<sup>33</sup>

**Control group.** The control group was a care group as usual. Participants completed the pretest, posttest, and stressful examination situation measurement at the same time as the intervention groups, and they had access to usual mental health care provided for students in the university. After the last measurement, the participants in the control group received access to the online game.

*Data analysis*

The study was performed during the semestrial examination session for college students to test the game-based CBT intervention's efficiency in an ecological stressful condition and students completed questionnaires one time before an examination. Dependent variables in our study were distress (measured with PED) and cognitions (measured with ABS-2-AV). The independent variable was the intervention (the therapeutic game with coaching for the first group, the therapeutic game for the second group, and no intervention for the control group). The within-subject variable in the study is time of measurement: baseline, during the examination situation and posttest. The data were analyzed using SPSS Software, and we performed variance analysis with the alpha level set to 0.05.



**FIG. 3.** Flow diagram of the progress through the phases of the trial. (1) Game-based CBT with guidance. (2) Game-based CBT without guidance. (3) Control. CBT, cognitive-behavioral therapy.

We performed two-ways mixed ANOVA for the main analysis to determine differences between groups from pretest to posttest and MANOVA to determine differences between groups in the ecological stressful examination situation. Then, we calculated the Reliable Change Index (RCI) to identify how many participants had reliable change and chi-squared to determine if there are differences between groups in terms of the reliable change. Also, Cohen's  $d$  was calculated to assess the magnitude of change. To interpret the effect sizes, we used guidelines suggested by Cohen<sup>34</sup> where 0.2 is considered a small effect size, 0.5 a medium one, and 0.8 a large effect size.

## Results

The progress of the participants during the phases of the trial is presented in Figure 3. In our sample we had a mean age of  $M=26.07$ ,  $SD=7.96$ , 17 males and 122 females who were randomized in 3 groups.

### Main analysis: two-ways mixed ANOVA

The means and standard deviations (SDs) for the pretest to posttest analysis for the outcomes measured can be found in Table 1. For the negative dysfunctional emotions, the Levene's test of homogeneity of variances showed that the assumption of homogeneity was not met for the pretest scores, and thus, following guidelines (Field, 2013), we controlled for its pretest level.

For the negative dysfunctional emotions (measured with PED), we found statistically significant group effect after the interventions  $F(2, 120)=14.44$ ,  $P=0.001$  (Fig. 4), and pairwise comparisons showed significant differences between game-based CBT plus guidance group and control group  $P=0.007$  with a Cohen's  $d$  of 0.37, which represents a small effect size, and significant difference between game-based CBT without guidance and the control group  $P=0.001$  with a Cohen's  $d$  of 0.51, which represents a moderate effect size. Post hoc test Sidak revealed significant differences between CBT without guidance group and control group,

$P=0.002$ , and significant difference between CBT with guidance group and control group,  $P=0.001$ .

After we calculated the scores on the PED scale, we used the norms for our country to categorize the participants' scores into the normed categories (low, medium, high). The scale has five categories: very low for scores below 14, low for scores between 15 and 17, moderate for scores between 18 and 25, high for scores between 26 and 42, and very high for scores over 43.<sup>30</sup> Then we performed chi-squared test to analyze if there are differences between groups in terms of normed categories for negative dysfunctional emotions, as an additional analysis to the main one. The frequencies in categories for negative dysfunctional emotions at pretest and posttest are presented in Table 2.

From pretest to posttest, we found in the game-based CBT with guidance there is a significant decrease,  $\chi^2(8, N=42)=21.80$ ,  $P=0.005$ , in terms of the frequencies of dysfunctional negative emotions. In the game-based CBT without guidance, there is a significant difference from pretest to posttest in terms of categories of negative dysfunctional emotions,  $\chi^2(6, N=39)=14.86$ ,  $P=0.021$ , but for the control group, there is no statistically significant difference in terms of frequency in the categories of negative dysfunctional emotions  $\chi^2(12, N=43)=16.52$ ,  $P=0.169$ .

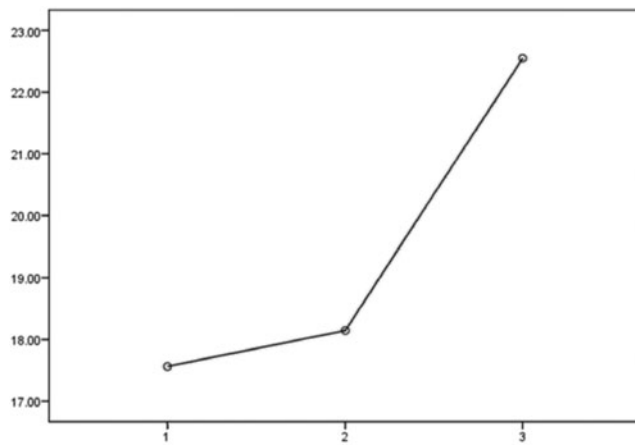
We also computed the RCI to analyze how many participants had indeed a reliable change in terms of reduction of negative dysfunctional emotions from pretest to posttest. The RCI is calculated by dividing the difference between the pretest and posttest of each participant with the SD of the measurement errors for the pre-post differences ( $S_{DIFF}$ ). The obtained results should be interpreted considering the scale (in our case, a decrease means an improvement, namely lower levels of negative dysfunctional emotions) and the  $P$ -value 0.05.<sup>35</sup>

In our sample, participants with significant lower result for RCI had a significant change in terms of negative dysfunctional emotions. We labeled, based on the result of RCI calculation, each participant with "change," "no change." Then we performed chi-squared test to investigate if there is significant difference between groups in terms of the frequency of participants with reliable change in the levels of negative

TABLE 1. MEANS, STANDARD DEVIATION, AND SAMPLE SIZE ( $N$ ) FOR ALL OUTCOMES FOR THE MAIN ANALYSIS

Variable/group	Game-based CBT with guidance group		Game-based CBT without guidance		Control group	
	M (SD)	N	M (SD)	N	M (SD)	N
ABS—rational cognitions subscale						
Pre	48.92 (7.61)	46	48.50 (7.71)	44	48.40 (7.73)	49
Post	52.42 (5.80)	42	52.35 (6.17)	39	49.27 (8.32)	43
ABS—irrational cognitions subscale						
Pre	30.06 (8.74)	46	28.02 (7.22)	44	29.06 (8.78)	49
Post	21.47 (7.54)	42	21.50 (7.84)	39	25.41 (8.89)	43
PED—total distress						
Pre	54.80 (17.77)	46	62.68 (24.92)	44	56.48 (21.18)	49
Post	42.57 (11.44)	42	49.41 (16.33)	39	47.72 (16.59)	43
PED: negative functional emotions						
Pre	29.69 (9.59)	46	33.59 (11.84)	44	27.48 (7.21)	49
Post	25.66 (9.22)	42	23.93 (4.66)	39	25.90 (10.10)	43
PED—negative dysfunctional emotions						
Pre	25.10 (8.64)	46	29.09 (13.69)	44	26.44 (11.28)	49
Post	17.23 (1.83)	42	18.64 (2.64)	39	22.41 (7.85)	43

ABS, Attitudes and Beliefs Scale; CBT, cognitive-behavioral therapy;  $M$ , mean; PED, profile of emotional distress;  $SD$ , standard deviation.



**FIG. 4.** Changes in dysfunctional negative emotions at posttest. (1) Game-based CBT with guidance. (2) Game-based CBT without guidance. (3) Control.

dysfunctional emotions. The result showed significant difference between groups  $\chi^2(2, N=124)=7.23, P=0.027$ .

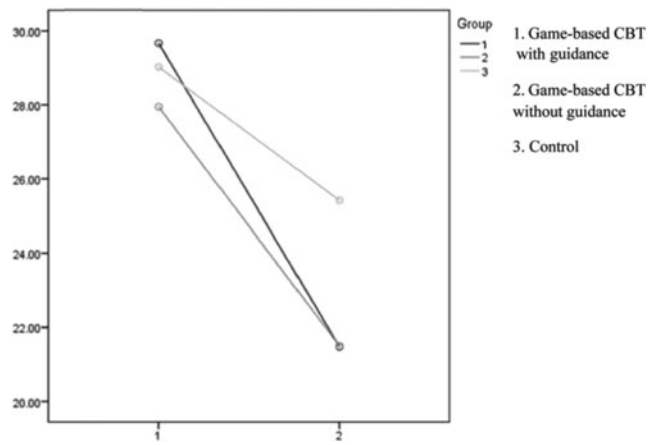
For the total distress and for functional negative emotions, we found significant effect of time, Pillai's Trace=0.265,  $F(1, 121)=43.58, P<0.001, \eta_p^2 = 0.265$ , respectively; Pillai's Trace=0.208,  $F(1, 121)=31.78, P<0.001, \eta_p^2 = 0.208$ , but the univariate did not reveal any significant changes (all  $P_s > 0.05$ ) for any of the groups.

For rational cognitions (measured with ABS), we found a significant effect of time, Pillai's Trace=0.133,  $F(1, 121)=51.39, P<0.001, \eta_p^2 = 0.113$ , but the univariate test did not result in any significant differences,  $F(2, 121)=1.16, P=0.31$ . However, the visual examination of the plot (Fig. 5) suggested that the game-based CBT groups have increased levels of rational cognitions compared with the control group.

For irrational cognitions (measured with ABS), we found a significant effect of time, Pillai's Trace=0.432,  $F(1, 121)=91.95, P<0.001, \eta_p^2 = 0.432$ , but the univariate test did not result in any significant differences  $F(2, 121)=1.20, P=0.30$ . The visual examination of the plot (Fig. 6) suggested that the game-based CBT groups have increased levels of rational cognitions compared with the control group.

TABLE 2. THE FREQUENCIES IN CATEGORIES FOR NEGATIVE DYSFUNCTIONAL EMOTIONS SUBSCALE FROM PROFILE OF EMOTIONAL DISTRESS AT PRETEST AND POSTTEST

Variable/ group	Game-based CBT with guidance group		Game-based CBT without guidance group		Control group	
	Pre	Post	Pre	Post	Pre	Post
Very low	0	2	0	2	0	0
Low	13	16	9	10	8	16
Moderate	13	16	12	19	24	17
High	18	8	17	7	11	9
Very high	2	0	6	0	6	1

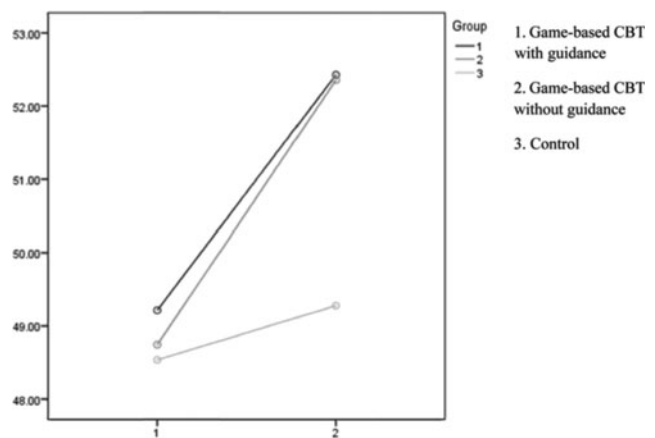


**FIG. 5.** Changes in irrational cognitions from pretest to posttest. (1) Game-based CBT with guidance. (2) Game-based CBT without guidance. (3) Control.

*Stress during examination situation analysis: MANOVA*

The means and SDs for the considered outcomes in the stressful examination situation can be found in Table 3. For this analysis, we performed MANOVA and the results in the examination situation for cognition and emotions indicated a significant time effect, Wilks' Lambda=0.853,  $F(10, 264)=2.183, P=0.019, \eta_p^2 = 0.076$ .

Then for rational cognitions (measured with ABS), we found marginally significant differences between the groups,  $F(2, 136)=2.61, P=0.07$ , and at pairwise comparisons, we found significant differences between game-based CBT without guidance group and control group,  $P=0.028$ , with a Cohen's  $d$  of 0.49, which represents a small-medium effect size, with the game-based CBT without guidance group having the highest level of gains in rational cognitions (Fig. 7). Post hoc test Sidak revealed marginally significant differences between CBT without guidance group and control group,  $P=0.08$ . There was no statistically significant difference between the two experimental groups  $P=0.49$ .



**FIG. 6.** Changes in rational cognitions from pretest to posttest. (1) Game-based CBT with guidance. (2) Game-based CBT without guidance. (3) Control.

TABLE 3. MEANS, STANDARD DEVIATION, AND SAMPLE SIZE (*N*) FOR ALL OUTCOMES IN STRESSFUL EXAMINATION SITUATION

Variable/group	Game-based CBT with guidance group		Game-based CBT without guidance group		Control group	
	M (SD)	N	M (SD)	N	M (SD)	N
ABS—rational cognitions subscale	51.52 (7.57)	46	52.52 (6.16)	44	49.34 (6.80)	49
ABS—irrational cognitions subscale	22.39 (9.00)	46	20.93 (7.22)	44	25.51 (8.87)	49
PED—total distress	50.02 (19.91)	46	50.90 (16.94)	44	50.32 (16.27)	49
PED—negative functional emotions	27.17 (9.89)	46	27.86 (8.64)	44	27.44 (7.73)	49
PED—negative dysfunctional emotions	22.13 (9.71)	46	19.31 (3.83)	44	22.46 (7.65)	49

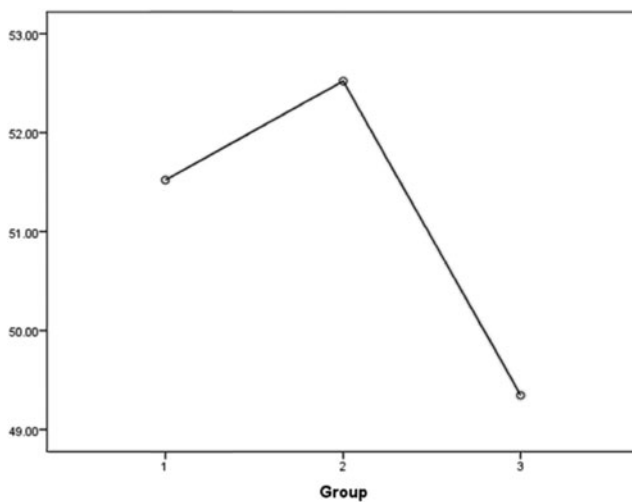
For irrational cognitions (measured with ABS), we found significant differences between groups  $F(2, 136) = 3.61$ ,  $P = 0.03$  (Fig. 8). Pairwise comparisons showed marginally significant differences between the game-based CBT with guidance group and the control group,  $P = 0.07$ , with a Cohen's  $d$  of 0.30, which represents a small effect size and significant differences between the game-based CBT without guidance group and control group,  $P = 0.01$ , with a Cohen's  $d$  of 0.51, which represents a moderate effect size. Post hoc test Sidak revealed significant differences between CBT without guidance group and control group,  $P = 0.03$ , and no significant difference between CBT with guidance group and control group. We found no statistically significant difference between the two experimental groups  $P = 0.49$ .

We did not find any significant differences between groups for the total distress (measured with PED), for the negative functional emotions (measured with a subscale of PED) and for the dysfunctional negative emotions (measured with a subscale of PED; all  $P$ s > 0.05).

## Discussion

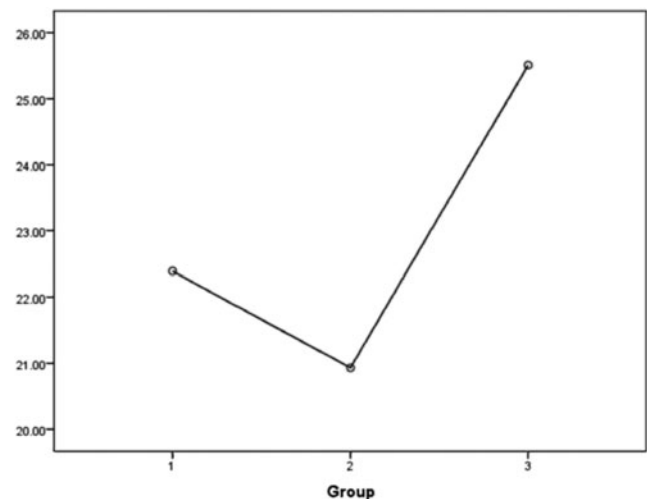
The aim of our study was to investigate the RETHink therapeutic game (with and without guidance) for reducing distress in college students. This is the first study that investigated the RETHink therapeutic game as a CBT-based intervention for addressing distress in college students. Moreover, we investigated the effects of complimenting the game with personal coaching. Our results suggest that RETHink game is a promising and attractive tool for helping with distress in college student population.

Our results showed that the students in both intervention groups that used the RETHink game reported reduced negative dysfunctional emotions with a small and moderate magnitude of change than students in the control group after the intervention. Also, there is significant difference between groups in terms of categorization of negative dysfunctional emotions from pretest to posttest and significant difference between groups for the reliable change in negative dysfunctional emotions. We did not find any significant differences for the total distress or for negative functional emotions



1. Game-based CBT with guidance 2. Game-based CBT without guidance 3. Control

**FIG. 7.** Changes in rational cognitions in the stressful condition. (1) Game-based CBT with guidance. (2) Game-based CBT without guidance. (3) Control.



1. Game-based CBT with guidance 2. Game-based CBT without guidance 3. Control

**FIG. 8.** Changes in irrational cognitions in the stressful condition. (1) Game-based CBT with guidance. (2) Game-based CBT without guidance. (3) Control.



between groups. The magnitude of changes in dysfunctional emotions results are promising and in line with the binary model of distress,<sup>36</sup> which suggests that in CBT/REBT, the main target are dysfunctional negative emotions, which are caused by irrational cognitions, and not functional negative emotions, which have positive effects on performance.

The fact that students reported lower distress only at posttest and not in the examination situation could be explained by the fact that students played a full level on the cognitive change ability and only a trial version of the other levels, including the one that targets emotions. Future studies should investigate the effect of the levels that train the emotions (level 1 and level 6) on the distress of college students in an ecological stressful examination situation.

Based on previous findings of the RETHink game mechanism of change,<sup>26</sup> it is expected that changes in cognitions from irrational ones to rational ones (which was the purpose of level 4 that students played) has impact on the negative dysfunctional emotions. There was no significant difference between the two experimental groups in terms of rational or irrational cognitions from pretest to posttest, but the visual examination and the means showed a difference between the two groups, with the game-based CBT with guidance being more effective. This is a very important result, and future studies should investigate the long-term effect of the game on distress and the contribution of the guidance to this effect.

Our results on the RETHink therapeutic game are similar to those obtained by David et al.<sup>25,26</sup> in terms of reducing dysfunctional emotions and irrational cognitions, which means that the use of the game can be successfully extended from children and adolescents to college student population. There is no other study to investigate a CBT game-based intervention for reducing distress or changing cognitions in students, but positive results for this type of intervention in students have been previously reported related to reducing mental health stigma<sup>23,24</sup> and improving self-efficacy. Our results are in line with other results of online interventions for college students in reducing stress and emotional problems.<sup>10</sup>

At posttest, we did not find significant differences between groups regarding cognitions, rational, or irrational, but the visual examination showed a tendency of the experimental groups to have an improvement in them, namely the intervention groups improved their rational cognitions and lowered their irrational cognition levels compared with the control group. In the stressful examination situation, the results on irrational cognitions showed improvements for both experimental groups compared to the control group with small and moderate magnitude of the change in irrational cognitions, meaning that the students in both experimental groups showed lower levels of irrational cognitions than the control group.

This result is of major importance and proves that online therapeutic game RETHink can be successfully used in ecological stressful situations to help college students change their cognitive vulnerability for mental illness. The nonsignificant changes at the posttest could be explained by the fact that beliefs are stable structures that need more time and exercise to obtain stable changes. Thus, we consider the cognitive changes in the distressing activating situation

promising and suggest that a longer period of game playing could result in statistically significant improvements in cognitions also at posttest.

For guidance, our results did not show an important contribution in the stressful condition, but at posttest, there is a tendency for the game-based CBT with guidance to have a slightly better improvement. It might be possible that guidance is important to make sure that the changes accomplished in the online intervention will be stable in time. Since there are experimental studies that show guided interventions are successful in reducing student distress,<sup>17,18</sup> one possibility is that guidance could be important for the long-term results.

### Limitation and Future Directions

Our study is not without limitations. First, we used only self-report measures, and future studies should include more objective measures like in-game scores and physiological measures of stress.

Another limitation of our study is the population used and future studies that investigate RETHink game should include all types of college students (not only psychology students) and students from all years of study (since in our study the sample consisted of last year students only) to ensure generalization of the findings. The fact that they received a small bonus for their implication in the study could also bias our results. Also, we did not investigate the long-term effects of the RETHink game, and future studies should investigate if the effects of the game are stable in time.

### Implications

Our results have both practical and scientific implications. For practitioners, our study raises the awareness of the importance of the college students' mental health and offers a new and innovative tool to use in their private practice with demonstrated results. For the scientific community, our results are important because it is the first study to use an online game-based CBT intervention with and without guidance. Also, our results contribute to the knowledge regarding mental health support in college students, offering evidence of the effectiveness of an online game-based CBT intervention in college students and answering to the widely discussed topic regarding the use of guidance in online interventions.

### Conclusion

In conclusion, this study suggests that RETHink therapeutic game can be an effective, accessible, and attractive solution for reducing distress during examination sessions in college students and support adaptive cognitive change processes.

### Informed Consent

Informed consent was obtained from all individual participants included in the study.

### Ethical Approval

All procedures performed in study involving human participants were in accordance with the ethical standards of the Institutional Research Committee. UBB-CMTTC 1396/10.02.2021.

### Data Availability

The datasets generated during and/or analyzed during the current study are not publicly available but are available from the corresponding author on reasonable request.

### Author Disclosure Statement

No competing financial interests exist.

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